RGB Night-Time Microphysics Quick Guide by NASA / SPoRT

Why is the Night-time Microphysics RGB Imagery Important?

The distinction between low clouds and fog is often a challenge. While the difference in the 10.8 and 3.9 channels has been a regularly applied product to meet this challenge, the Night-time Microphysics RGB adds another channel difference to indicate cloud thickness and repeats the use of the 10.8 thermal channel to enhance areas of warm clouds where fog is more likely. Other applications include analysis of cirrus and contrail clouds, fire hot spots, and snow.

RGB Night-time Microphysics Product - What is used in the combine and what does each color represent?

Color	Band / Band Diff.	Physically Relates to….	Little contribution to composite indicates…..	Large contribution to composite indicates …..
Red	**12.0 – 10.8**	Optical Depth	Thin clouds	Thick clouds
Green	**10.8 – 3.9**	Particle Phase and Size	Small water or ice particles of similar size	Presence of large water particles
Blue	**10.8**	Temperature of surface	Cold surface	Warm surface

What should I be looking for in the imagery?

Fog and low clouds in warm climates tend to have aqua or light blue areas in the RGB. This appears very light green in colder climates because the 10.8 thermal channel used for the blue band in the RGB contributes less.

Low clouds, warm climate	Low clouds, cold climate

In general, areas of fog and low clouds in the standard 10.8-3.9 difference product will look similar to the aqua blue areas in the RGB. However, the RGB and 10.8-3.9 product will differ in some cases, such as when clouds are above the surface (see 2011, November 11 example). These low clouds above the surface appear in shades of tan and light green as they are higher and tend to be colder, which means less blue coloring. Mid-level cloud colors lean toward green (thin, less red) to light brown (thick, more red).

For fog and low clouds the thickness may vary, therefore the RGB red contribution may also vary. Thick clouds or fog that extend above the surface may have nearly equal amounts of red and blue contributions with large amounts of green in the RGB. This combination produces the aqua color as we might expect for low clouds or fog in warm climates.

However, relatively shallow can reduce visibility to IFR levels or lower, and the resulting RGB color in these areas can appear to have more of a purple coloring with hints of the light blue and aqua areas mixed together (see 2012, March 25 example).
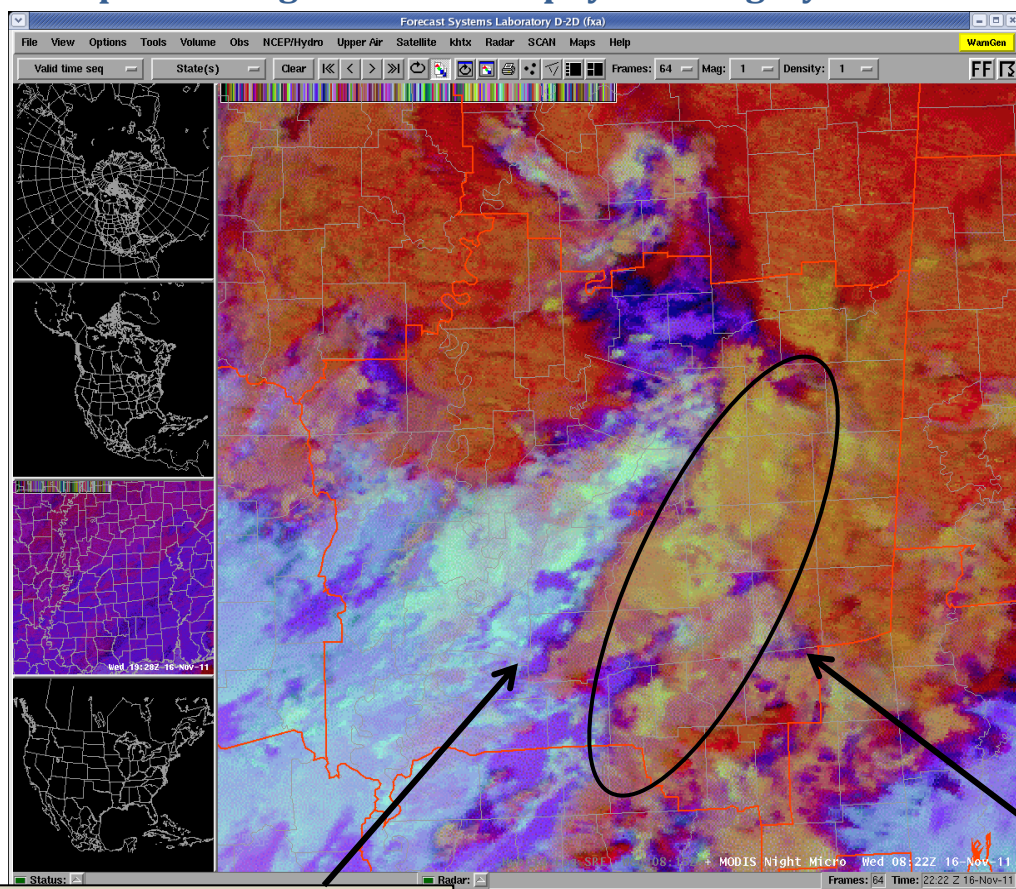
Fog very near surface

This occurs mostly because of the reduction of green in the RGB in these areas. Essentially, there is slightly more blue (temperature) than red (thickness), but of most significance is that the green has been reduced because the 3.9 channel is seeing some emissions from not only the fog but the surface as well. Hence the 3.9 channel is warmer and the difference from the 10.8 is less in this near surface fog event, resulting in less green-coloring.

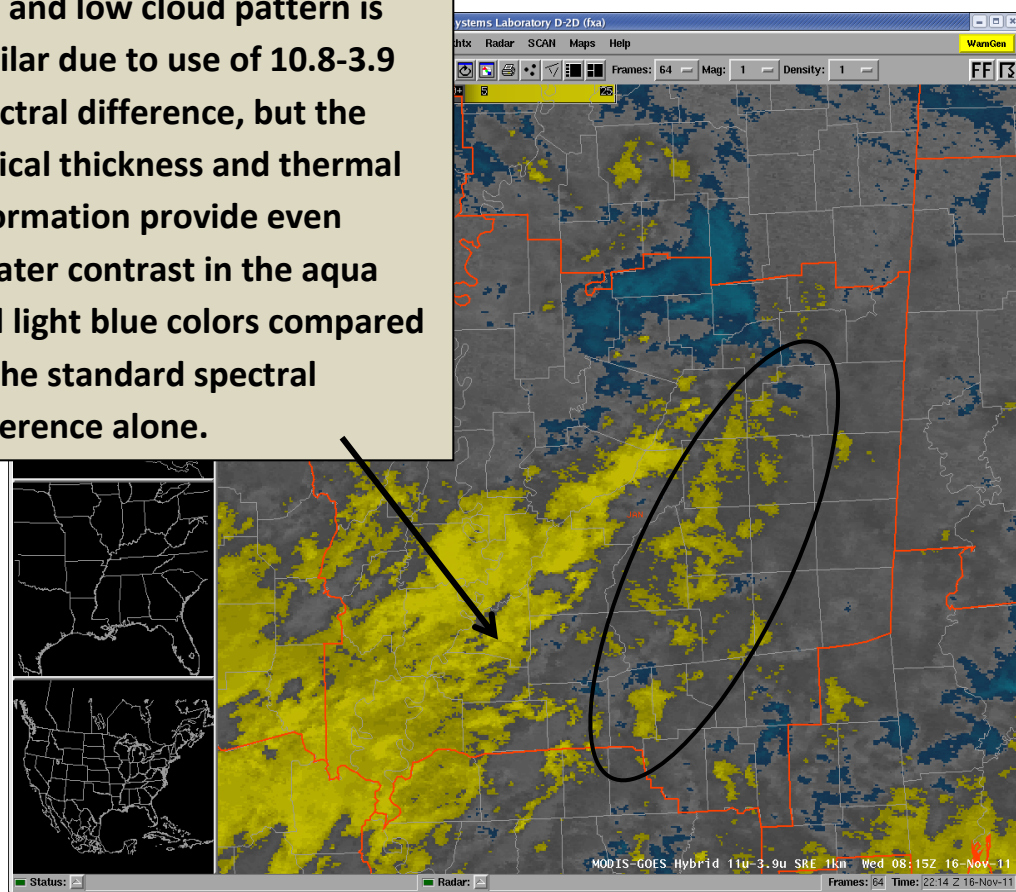**What are the things to watch out for?**

The 3.9 channel is subject to noise at very cold temperatures. Fog at high latitudes in winter may have noise in the pixels representing fog. Similarly, the depiction of very high, cold clouds (i.e. cumulonimbus tops) will have yellow pixels mixed in areas of dark red for this RGB due to the 3.9 channel noise at such temperatures.

Example RGB Night-Time Microphysics Imagery from MODIS – 2011, November 11

Less blue in this area, therefore, colder clouds. These are clouds closer to mid level, rather than low level or near surface.
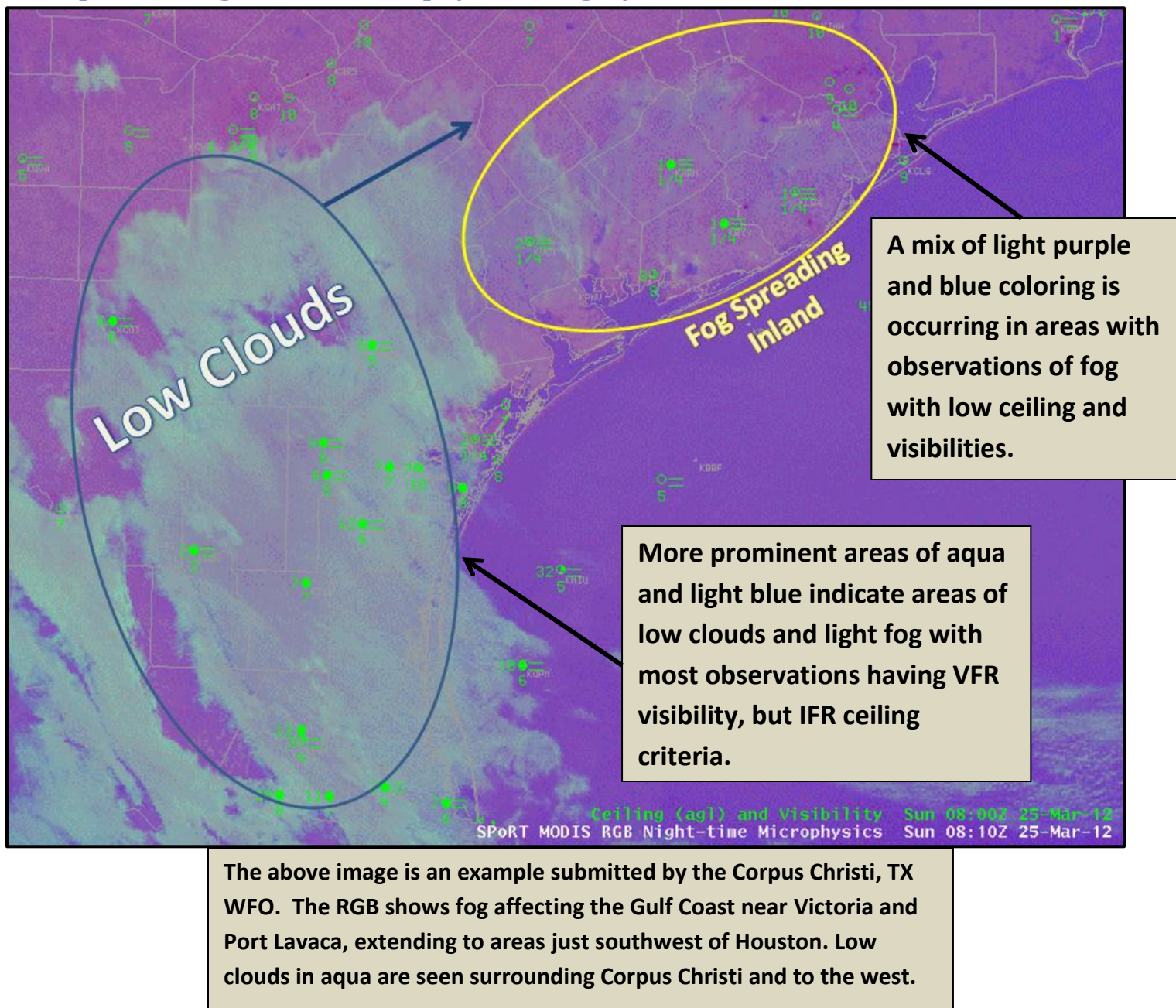
Fog and low cloud pattern is similar due to use of 10.8-3.9 spectral difference, but the optical thickness and thermal information provide even greater contrast in the aqua and light blue colors compared to the standard spectral difference alone.

Example RGB Night-Time Microphysics Imagery from MODIS – 2012, March 25

Low Clouds

Fog Spreading Inland

A mix of light purple and blue coloring is occurring in areas with observations of fog with low ceiling and visibilities.

More prominent areas of aqua and light blue indicate areas of low clouds and light fog with most observations having VFR visibility, but IFR ceiling criteria.

Ceiling (agl) and Visibility   Sun 08:00Z 25-Mar-12
SPoRT MODIS RGB Night-time Microphysics   Sun 08:10Z 25-Mar-12

The above image is an example submitted by the Corpus Christi, TX WFO. The RGB shows fog affecting the Gulf Coast near Victoria and Port Lavaca, extending to areas just southwest of Houston. Low clouds in aqua are seen surrounding Corpus Christi and to the west.

Resources:

This guide provides a highlight of the Night-time Microphysics RGB product as quick reference. Operational applications of RGB imagery can be seen on SPoRT's blog site (http://nasasport.wordpress.com/). A primer of the RGB imagery concept can be found at the UCAR/COMET MetEd website (https://www.meted.ucar.edu).More in depth information can be found at EUMETRAIN's website (http://eumetrain.org/).